(11) (A) No. 1042818

(45) ISSUED 781121

(52) CLASS 182-132
C.R. CL.

(51) INT. CL. [2] E02B 15/04

(19) (CA) **CANADIAN PATENT** (12)

(54) OIL CLEAN-UP APPARATUS

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(21) APPLICATION No. 235,163
(22) FILED 750910

(30) PRIORITY DATE

No. OF CLAIMS 5

DISTRIBUTED BY THE PATENT OFFICE, OTTAWA.
CCA-274 (12-76)

OIL CLEAN-UP APPARATUS

ABSTRACT OF THE DISCLOSURE

Apparatus for removing an oil spill from the surface of a harbour includes a vessel fitted with sweeping booms each carrying a number of motor driven feed augers which are vertically spaced apart to extend generally parallel to the water surface on which a layer of oil is floating. A buoyant sump box is mounted for vertical sliding movement near the inner end of each boom and pumping equipment connects this box to a holding tank aboard the vessel. As the vessel is moved forward through an oil slick, the boom sweeps the oil towards the vessel with this sweeping action being augmented by the driving action of the rotating augers. The sump boxes float freely with respect to the booms so as to maintain a position which will best receive the swept and driven oil for transfer to the holding tank.

My invention relates to apparatus particularly intended for use in removing oil accidentally spilled in a harbour or elsewhere.

The various pieces of equipment which are presently being used to clear up an oil spill have proven to be unsatisfactory for a number of reasons and one of the most serious of these is that the equipment can only operate under almost ideal conditions. If it is windy and the sea is even slightly choppy, the boats or barges which carry the equipment will roll and the intakes or pick-up devices relied upon to gather up the oil will be floaded with water to the extent that the whole clean-up operation may be rendered ineffective.

I overcome these as well as other disadvantages by providing apparatus designed to operate effectively even in adverse conditions such as when the surface of the sea might be roughened so that the apparatus cannot be kept on an even keel.

More specifically, oil clean-up apparatus according to the present invention may be defined as comprising a vessel having a storage tank, a boom projecting from a side of the vessel partially submerged in the water, a plurality of augers rotatably mounted on the boom in vertically spaced and parallel relation, drive means for rotating the augers in unison and in the same direction to propell oil into a collection pocket near the inner end of the boom, a sump box within the collection pocket to receive the propelled oil, and pumping means for transferring oil from the sump box to the storage tank.

In drawings which illustrate a preferred embodi-

ment of the invention,

Figure 1 is schematic plan view of the present apparatus,

Figure 2 is a front elevation showing sweeping booms of the apparatus with parts being broken away,

Figure 3 is an enlarged vertical section of the boom taken on the line 3-3 of Figure 2,

Figure 4 is a fragmentary horizontal section of the boom taken on the line 4-4 of Figure 2, and

Figure 5 is a perspective view showing a sump box of the apparatus.

Referring to the drawings, the numeral 10 indicates generally oil clean-up apparatus constructed in accordance with the present invention. Apparatus 10 comprises a suitable vessel 12 which is powered by an engine 13 adapted to drive a propeller 14. A large holding or temporary storage tank 16 is stored below decks of the ship which is otherwise conventionally equipped to operate in harbours and coastal waters where oil spills are likely to present a clean-up problem.

Apparatus 10 includes a pair of sweeping booms 20 mounted one on each side of the ship 10. Each boom 20 is secured to an adjacent side 21 of the ship by mounting means generally indicated at 24. As shown best in Figures 1 and 2 the means 24 is a hollow sturdily built structure 26 which projects a short distance laterally of the ship's side. Brackets 27 are provided on upper and lower faces of the structure 26 and these brackets carry vertically aligned pivot shafts 28 which are suitably journalled within an inner end 29 of the boom. Thus each boom is mounted for

swinging movement about a substantially vertical axis with the boom normally being immersed to about mid-height in water. This is the sweeping position assumed by the booms when the vessel 12 is being moved forward through an oil slick floating on the surface of the water.

The apparatus 10 includes positioning means generally indicated at 30 for adjusting the angle of each boom 20 with respect to the side of the vessel. Figure 1 shows the means 30 as comprising power-driven capstans 32 and 33 which are mounted on deck 34 of the vessel near the stern and bow thereof. The opposite ends of a length of cable 35 are wound upon these capstans and an intermediate part of this cable is secured as at 36 to outer end 37 of the boom. In Figure 1, the solid line position of the booms 20 are their normal operating or oil-sweeping positions at which time they are braced by the positioning means 30 inclined forwardly at an acute angle to the side 21 of the ship. Each boom 20 then defines with the structure 26 and the ship's side 21, a space which will hereinafter be referred to as a collection pocket and which is designated by the numeral 38 as the area with the dotted lines appearing in Figure 1. Oil and, of course, some surface water is moved into the pocket 38 as a clean-up sweep is made by the ship. When the vessel 12 is required to proceed without sweeping, the capstans 32 and 33 are operated to wind the cables 35 whereby to swing the booms 20 rearwardly and substantially parallel to the sides 21 of the ship as indicated by dotted lines in Figure 1.

As shown best in Figures 3 and 4, each boom 20 is a hollow structure which is made buoyant so as to support a

large part of its own weight in water. The boom 20 has a plain rear wall 40 and a front wall 41 which is shaped to define three vertically spaced and substantially semi-circular channels 42. Rotatably mounted in each channel 42 is a feed auger 45 which is journalled in bearings 46, see particularly Figure 4, these bearings being suitably secured to the front wall 41 of the boom.

The three augers of each boom 20 are adapted to be driven in unison and in the same direction by drive means generally indicated at 50. In Figure 4, the means 50 of one auger is shown to comprise a hydraulic motor 52 which is mounted within the hollow boom 20 preferably on the rear wall 40. An enclosed drive train 53 of the motor sealingly extends through an opening 54 in the front wall 41 to operatively connect with shaft 55 of the feed auger. A hydraulic circuit including flexible hose lines 56 connect the motor 52 to a source of hydraulic pressure (not shown) aboard the vessel 12. The centre auger 45 normally rotates in the water-borne oil to propell that oil into the adjacent collection pocket, the lowermost auger drives sub-surface water in the same direction to augment the propelling action of the centre auger, while the rotating uppermost auger only comes into play if the water is rough or the ship is rolling slightly.

The wall portion 44 of each boom is provided with vertically disposed guides 70 which support a sump box 72. This box 72, see particularly Figure 5, is supported in the guides for vertical sliding movement and, since the box is also a buoyant structure, it is capable of moving relative to the boom whenever both are partly submerged in water.

Normally, the boom is immersed to about the depth of the middle auger and the sump box floats so that the water level is around the line indicated at 75 in the drawing.

Oil which enters a sump box 72 is removed by pumping means generally indicated at 80. Figures 1 and 2 show means 80 as comprising a deck-mounted pump 82 fitted with a flexible intake hose 83. This intake hose 83 extends downwardly to connect with an intake nozzle 84 (Figure 5 only) mounted in the sump box 72. Pump 82 has a discharge pipe 86, see Figure 2, which extends into the storage tank 16.

In operation, the vessel 12 is moved slowly forward through an oil slick with the booms 20 inclined slightly forward as shown in Figure 1. The augers 45 are rotated at a speed commensurate with the forward speed of the vessel whereupon the gathered-in oil is delivered into the sump boxes 72 along with some surface water. These buoyant sump boxes will move up and down if the sea is slightly rough but generally will be in a position to receive the oil and surface water both of which are transferred to the holding tank 16 by the pumping means 80. Should the ship be rolling slightly, the centre auger will not always be at sea level as normally is the case. However, the top and bottom augers take over more of the oil-propelling action whenever the booms are raised or lowered as a result of the vessel rolling so that the sweeping and propelling of the contaminating material is a substantially continuous operation. The oil and water mixture deposited in the storage tank is separated using other equipment (not shown) and the water is returned to the sea.

From the foregoing, it will be apparent I have provided oil clean-up apparatus which can be used in conditions of sea and weather which would render ineffective the operation of conventional clean-up equipment.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Apparatus for removing contaminants such as spilled oil from the surface of a body of water comprising

a vessel having a storage tank,

a boom projecting from a side of the vessel partially submerged in the water,

a plurality of augers rotatably mounted on the boom in vertically spaced and parallel relation,

drive means for rotating the augers in unison and in the same direction to propell oil into a collection pocket near the inner end of the boom,

a sump box within the collection pocket to receive the propelled oil, and

pumping means for transferring oil from the sump box to the storage tank.

2. Apparatus as claimed in claim 1, in which said sump box is a buoyant structure, and guide means supporting the sump box partially submerged in the water for vertical sliding movement in response to wave motion on the water surface.

3. Apparatus as claimed in claim 1, and including mounting means pivotally securing an inner end of the boom to the side of the vessel for swinging movement about a substantially vertical axis, and

positioning means connecting an outer end of said boom to the side of the vessel whereby the boom is positionable between a parallel position and an inclined position with respect to the side of said vessel.

4. Apparatus as claimed in claim 1 or 2, in which said boom is a hollow buoyant structure having a front wall, said front wall having a channel for each auger adapted to direct oil towards the collection pocket.

5. Apparatus for removing contaminants such as spilled oil from the surface of a body of water comprising

a vessel having a storage tank,

a boom projecting from a side of the vessel, said boom being a hollow buoyant structure having a front wall, said front wall having a plurality of vertically spaced channels,

mounting means pivotally securing the inner end of the boom to the side of the vessel for swinging movement about a substantially vertical axis,

positioning means connecting an outer end of said boom to the side of the vessel whereby the boom is positionable between a parallel position and an inclined position with respect to the side of the vessel,

an auger rotatably mounted on the front wall of the boom within each channel,

drive means on the boom for rotating the augers in unison and in the same direction to propell oil into a collection pocket near the inner end of the boom,

a buoyant sump box within the collection pocket to receive the propelled oil,

guide means supporting the sump box for vertical sliding movement relative to the boom in response to wave motion on the water surface, and

pumping means for transferring oil from the sump box to the storage tank.

Fig. 1.

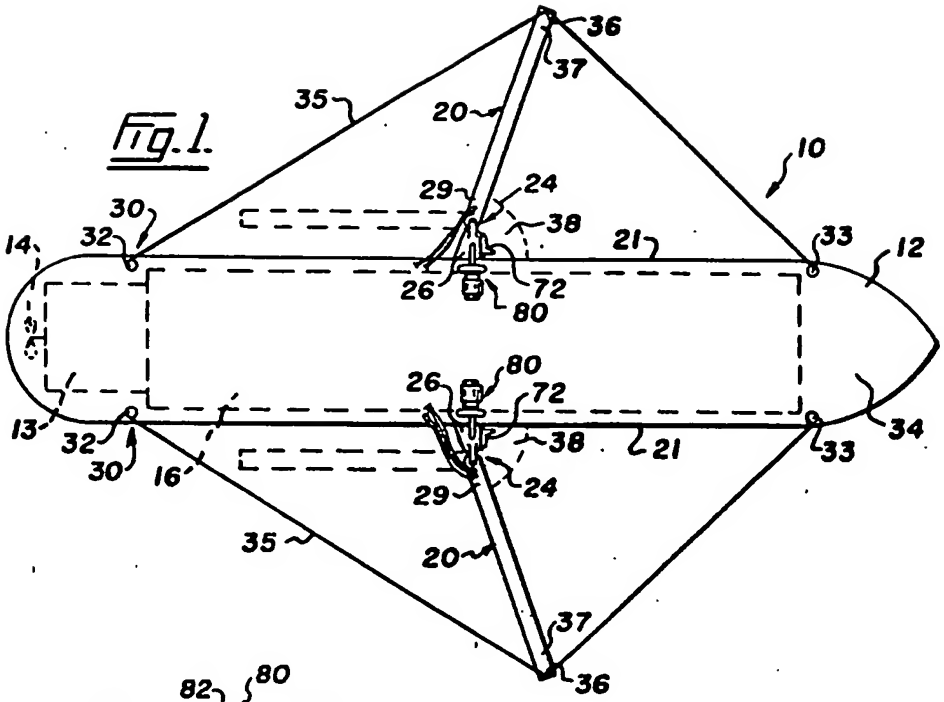


Fig. 2.

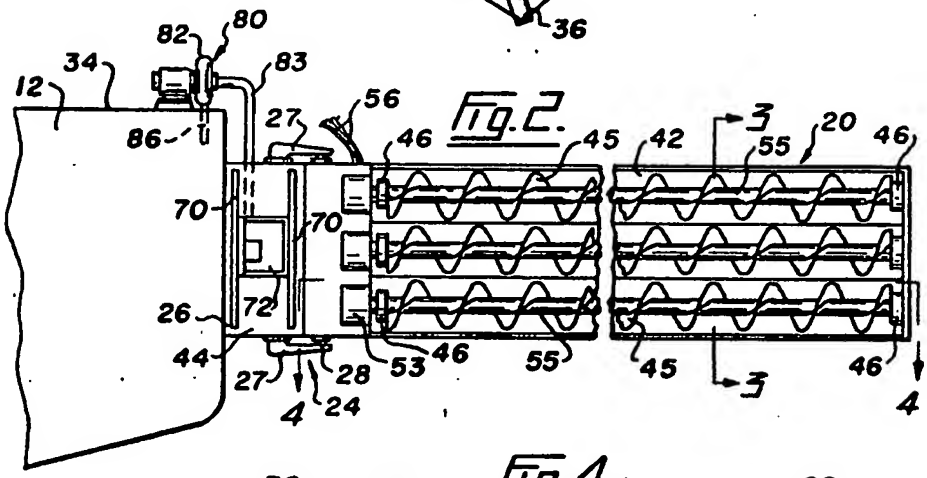


Fig. 4.

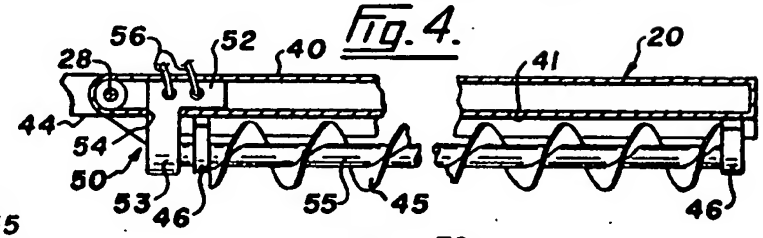
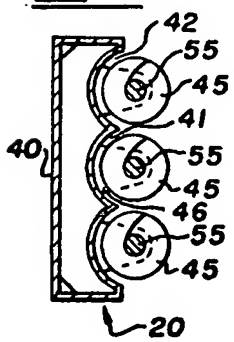


Fig. 3.



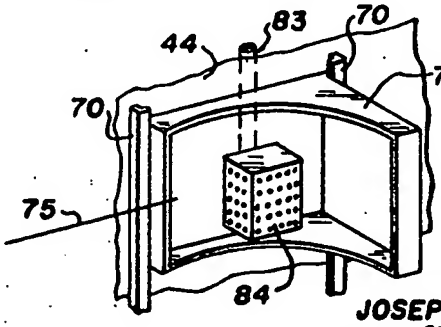


Fig. 5.

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